CONSERVATION FARMING FOR THE HARD LANDS OF THE SOUTHERN GREAT PLAINS

SOIL CONSERVATION SERVICE
U.S. DEPARTMENT OF AGRICULTURE

THIS IS ONE of a series of three publications that deal separately with the conditions and problems that must be met in effecting soil and water conservation on three distinctive kinds of land in those parts of Kansas, Colorado, Oklahoma, Texas, and New Mexico included in the southern Great Plains. It furnishes practical guidance in soil and water conserving methods for farmers of the hard lands. Similar publications are being printed for farmers of the sandy lands and the range lands of the southern Great Plains.

The text sets forth briefly (1) the necessity for adapting soil and water conservation practices to the land; (2) a designation of the broad classes of land of the southern Great Plains that may respond to similar conservation treatments and a description of the hard lands dealt with in this bulletin; (3) the need for a careful selection and a close coordination of conservation practices to fit each situation; and (4) a discussion of conservation-farming methods recommended by the Soil Conservation Service for use on the hard lands of this region.

Soil and water conservation practices have been widely adopted in the southern Great Plains during recent years. Much information is available about the installation of the practices most commonly used; however, the need for further information on planning for a complete, coordinated, conservation-farming program has become apparent as the conservation movement spreads. This publication has been prepared primarily for those farmers who are already familiar with commonly used conservation practices but need more information about the selection and coordination of the practices that will fit best their particular type of land and farming system.

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Conservation Farming for the Hard Lands of the Southern Great Plains

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INTRODUCTION

Farming With the Climate

In a country of sparse and irregular rainfall, where high, erosive winds prevail during critical periods and the weather is never predictable from one season to the next, residents of the Plains have come to recognize that farming is at its best a rather hazardous enterprise.

The hazards of farming may be lessened, however, by practice of conservation farming adapted to the climate. Variations in length of growing season and in the expected amount of rainfall should govern farm plans, according to the locality. The erratic character of the rainfall also should be given full consideration in planning for farm operations. Likewise, the virtual certainty of high winds in the spring and the probability of hot winds in the summer must influence farming plans.

The experienced Plains farmer has one advantage in dealing with the climate. He recognizes that he must make plans that can be changed to fit the weather inconsistencies as they occur; and, once he has learned to farm with the climate instead of hoping that the weather will fit his plan, he finds that the production of profitable crops is possible on the southern Plains during most years.

Farming That Fits the Land

The land of the region, like the weather, is variable. Broad stretches of almost level land are common on the Plains, but undulating, rolling, and steep, broken lands also are present in most sections. Silt and clay loams, loams, sandy loams, loose sands, and tight clays are interspersed throughout the region. Deep soils and shallow soils commonly lie side by side. Some fields have been seriously damaged by erosion, while neighboring fields of the same type have been but little eroded. Some of these differences are hardly discernible to the inexperienced, but, nevertheless, may be highly important to the practical farmer and call for corresponding variations in farming practices.

Any successful program of conservation farming must fit the land of the farm. It will probably be necessary to vary the program for different fields on the same farm. The slope of the land, the water-absorbing and water-holding capacity of the soil, and the expected use of a field should be determining factors in planning for water conservation. The depth of the soil, its texture and structure, and the character of the subsoil should govern its use and influence the system of crop management. The type of land on the farm will largely determine the type of farming most practicable. These are but a few examples of the way physical land conditions must influence the farm program.

Three Broad Classes of Land

The lands of the southern Great Plains may be divided roughly into three broad classes for the purpose of discussing adapted conservation treatments for dry-land farming. These broad classes are: (1) The hard or tight lands with soil deep enough for profitable cultivation; (2) the sandy and mixed lands that are suitable for cultivation; and (3) the lands adapted only for range purposes (such as shallow soils, loose sandy soils, very tight clays, and rough, broken, or stony lands).

Each of these three broad classes should be divided into several groups, according to variations in physical land conditions, climate, and adapted crops where definite conservation-farming recommendations are made; and a detailed survey of the land that shows the soil type, slope, erosion, and present use of each field is needed on every farm where detailed farm plans are developed. Since, however, the conservation treatments that should be applied to most kinds of land within each of the three broad classes mentioned above will be similar in many respects, it seems feasible to discuss methods applicable to

the hard lands as a whole, with more specific recommendations for various problem-area groups of land within the class.[1]

THE HARD LANDS

Only the hard or tight lands that may sometimes be used for cultivation are discussed in this publication. These lands are referred to hereafter as the hard lands or the hard croplands. They include most of the loam, silt-loam, and clay-loam soils having topsoils of at least medium depth and subsoils that are relatively deep and not too tight for plant roots to penetrate. For the purpose of recommending specific conservation practices and farming operations, however, the hard lands are broken down into groups of land with more similar physical characteristics and crop adaptations, and subject to similar climatic conditions.

Based on physical characteristics, the hard lands may be divided roughly into two groups: (1) The deep soils and (2) the medium-depth soils. In this publication, the term "deep soils," includes the hard lands that have a relatively deep topsoil and a combined depth of topsoil and subsoil not too tight for plant-root penetration of 30 inches or more. The term "medium-depth soils" includes hard lands that have a topsoil of at least a medium depth and a combined depth of topsoil and permeable subsoil ranging from 16 to 30 inches. Areas that originally had a deep soil may have only a medium-depth soil if erosion has removed most of the topsoil. Medium-depth soils may become shallow soils if severe erosion occurs. Since tight, shallow soils of this region generally are not suitable for crop producton, they are not discussed in this publication.

Since there are many variations in soil type, depth, and structure within each group, it may be difficult to distinguish between the deep soils and the medium-depth soils. On some areas a detailed survey of the land may be necessary. Such surveys are recommended as a preliminary step to making detailed plans for a long-time conservation-farming program on any farm.

Soils

Soils of the hard lands range in texture from loams to clays. The clay loams predominate. Many soil series are represented in this class. The deep soils have a friable, crumb, or granular topsoil, whereas the medium-depth soils have a massive to crumb structure and are usually friable throughout. The subsoils range from a granular structure in the upper part to an angular clod or prismatic structure in the lower part.

[1] U. S. Soil Conservation Service. PROBLEM-AREA GROUPS OF LAND IN THE SOUTHERN GREAT PLAINS. 40 pp. February 1939.

Depth is important in soils of this kind. The combined depth of the topsoil and the permeable subsoil largely determines the feeding zone of crop roots, and the water-holding capacity of the soil is usually in proportion to the total depth of topsoil and subsoil. Crop yields are normally greater on the deep soils than on medium-depth soils, and crop failures, if rainfall is utilized properly, are less frequent.

In general, the soils of the hard lands have a high moisture-holding capacity. On the more gentle slopes the rate of run-off is slow. How-

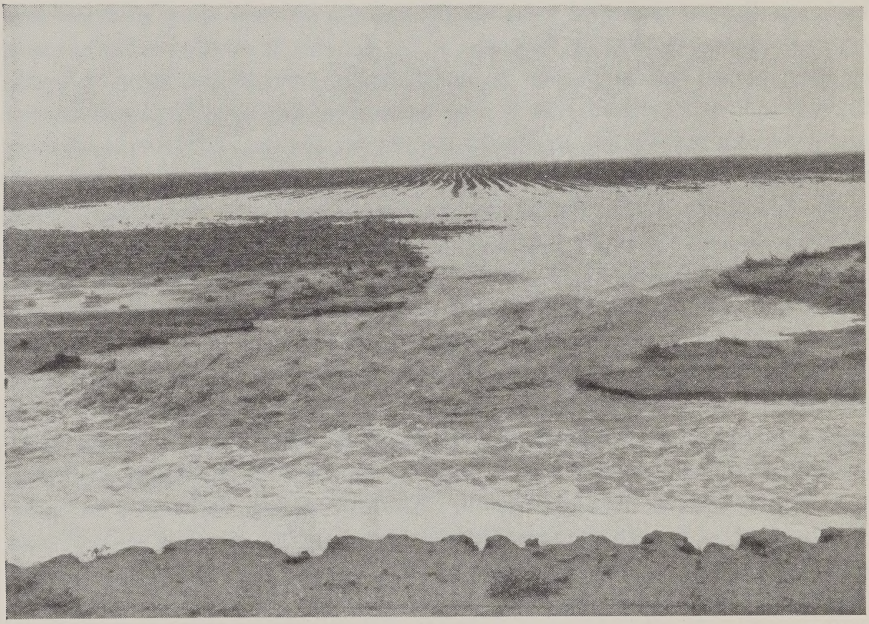

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FIGURE 1.—Run-off from a slope of less than 2 percent on hard land with lister furrows running down the slope. Because of the slow absorptive rate of the soil, a large amount of run-off may occur during heavy rains, even on almost level lands.

ever, since these soils usually absorb moisture very slowly, a large amount of run-off may occur during heavy rains even on almost level lands (fig. 1), and on the steeper slopes run-off may be rapid enough to cause losses of soil by sheet erosion.

Under virgin conditions the topsoils contain a moderate amount of organic matter. The deeper soils usually have reached a more mature stage of development and, therefore, contain a higher percentage of organic matter and are more fertile. The deep soils in general are good wheatlands when properly farmed; the medium-depth soils are better adapted for sorghum production and for grazing lands.

Physiography

The hard lands of this region generally occur on gently sloping to almost level areas, many having slopes of 1 percent or less. External drainage systems are poorly developed in many sections. From much of the more level land the run-off collects in numerous intermittent shallow lakes or playas, but on some of these lands on the loessial and rolling Plains external drainage is well-developed. The slopes, even in the rolling and undulating areas, are moderate—seldom more than 5 percent. The deep soils normally occupy the gently sloping to nearly level areas, and the medium-depth soils predominate on the undulating and rolling areas.

Location and Extent

The hard lands occur largely on the High Plains between the one-hundredth and one-hundred-fourth meridians from the northern boundary of Colorado and Kansas to the southern boundary of New Mexico. The deep soils generally lie along the eastern side of this region, whereas most of the medium-depth soils lie higher on the Plains and to the west. Much of the area that makes up this type of land is in large tracts, but small patches are scattered throughout the Plains. The deep soils cover approximately 16,000,000 acres and the medium-depth soils about 11,000,000 acres.

The map of the region (inside back cover) depicts the general location and extent of the larger areas of hard lands. It distinguishes between the deep soils and the medium-depth soils. It also divides the deep soils into three groups according to crop adaptations.[1] The parts of the map without cross-hatching represent areas with other types of land.

A line across the map in a general north and south direction further divides the region on the basis of effective annual precipitation in normal years and is referred to hereafter as the effective rainfall line. This line marks a rainfall belt receiving from 15 inches of precipitation at the north to 18 inches at some points toward its southern end. Fifteen inches of precipitation in the northern part of the region may be as effective as 18 inches in the south because of diminished losses by evaporation in the cooler north. To the west of the line the precipitation is less, to the east it is greater.

The areas of land types depicted on the map are as accurate as existing information and the scale of mapping permit. Within the boundaries of most areas outlined are tracts of land too small to map which are of a different type. Further refinement of the map, however, must depend on detailed surveys. It is intended that the recommendations of this publication be applied only to the lands

[1] U. S. Soil Conservation Service. Problem-area groups of land in the southern great plains. 40 pp. February 1939.

described as hard lands and not strictly to the areas shown as such on the map.

Climatic Environment

There is a wide range in climate over the region discussed in this bulletin. The frost-free growing season ranges from more than 220 days in the southern part of the region to less than 135 days in the foothills of the Rocky Mountains to the northwest. The wind velocities vary for different sections and from year to year in the same locality. There are many other variables in the climate that influence farming and conservation practices. Probably the most important climatic factors that affect use of the hard lands, however, are the amount and timeliness of rainfall and snow.

From east to west across the region the average total amount of annual precipitation ranges from 22 inches or more to less than 12 inches. Most of the hard lands lying east of the effective rainfall line (see map, inside back cover) are considered suitable for cultivation if good soil- and water-conservation practices are used. Much of the area west of this line is considered suitable only for grazing, but some of the deeper soils on gentle slopes may be farmed profitably by an intensive use of water- and soil-conserving practices. Near the mountains in the western edge of the region are small areas of hard lands receiving 15 inches or more of rainfall annually and having a relatively low evaporation rate which are considered suitable for dry-land farming with an intensive use of conservation measures.

Erosion

Wind erosion, during recent years, has damaged much of the cultivated hard lands, and some of the pasture and range lands. Erosion has been severe on many tracts of the medium-depth soils, especially in areas west of the effective rainfall line (fig. 2).

The deep soils and most of the medium-depth soils lying east of the effective rainfall line are moderately susceptible to erosion by wind; however, it is considered entirely feasible to control erosion on most of these lands while retaining them in cultivation if proper conservation-farming methods are used.

The hard lands of this region are slightly to moderately susceptible to water erosion. On undulating or rolling lands during periods of torrential rainfall erosion by water may become so severe as to damage the land permanently.

CONSERVATION FARMING

The problems of the Plains are complicated and the treatment must necessarily be complex. Fortunately, there now are many types of proved soil- and water-conservation practices available for use by

Plains farmers. Terraces, contour tillage, strip cropping, border strips, cover crops and residue management, rough tillage, fallow, controlled grazing, contour furrows, tree plantings, and revegetation are but a few of the most commonly used practices that are adapted to various types of land. The exclusive use of any single practice, however, cannot be expected to solve the numerous problems involved in crop failures and soil erosion any more than a single implement can be expected to serve as a plow, planter, cultivator, and harvesting machine.

COLO-303-A

FIGURE 2.—In areas where successive crop failures and accelerated wind erosion have depleted the humus of the soil, thousands of acres of the hard lands have been abandoned and now lie idle, completely bare of all vegetation.

The best soil- and water-conservation program will make use of all practices adapted to the land and the climate. The selection of the best practices to serve the desired purpose may require careful judgment, and a thorough study of the land of the farm and the farming system should precede the installation of the program.

COORDINATION OF CONSERVATION PRACTICES

Each practice should be so planned and carried out that it will support best the other conservation methods in use. Water conservation by terracing and contour tillage produces the desired results only

when used in connection with a sound program of soil and crop management. Strip cropping for the hard lands is more effective if on the contour and supported by terraces. Emergency tillage may sometimes be necessary to control soil blowing, but it will be most effective where crop residues have been incorporated in the soil and soil moisture has been conserved. In general, fallow for moisture conservation is safe only when cloddy tillage and residue management are practiced and gives the greatest increase in crop yields when used with terraces, contour tillage, and strip cropping. Cover crops will control erosion, but they usually are not profitable unless the farm supports a livestock enterprise and often they cannot be grown at the proper time except where water is conserved and flexible cropping plans are given careful thought ahead of time. In a similar fashion the degree of success of almost any conservation measure advocated will depend on its proper coordination with other practices.

Economic Factors

Assuming that all adapted types of soil- and water-conservation practices are used and that such practices are coordinated properly, the conservation program yet may fail if economic factors are ignored. It is not enough to consider only the climate and the land. The farm operator also must be considered. True conservation is not hoarding. It profits the farmer but little to save his soil with cover crops and be unable to market the produce of these crops. Water stored in the soil by conservation methods is of little value unless it can be used for the production of profitable crops. The conserved soil and water should be used efficiently if the true objectives of conservation are to be accomplished.

On some farms it may be necessary, within the limits of safety, to modify the ideal conservation program in order that the farm may produce income enough to support its operator. Since the most serious erosion of the Plains is usually on abandoned farms, farm organization and management that will assure an income sufficient to keep the farm operator on the land must be considered an essential part of the conservation-farming program.

Changes in Land Use

Land must be used for purposes to which it is adapted if farming is to be successful and the soil productivity conserved. The breaking out of virgin sod on lands suitable only for grazing is a mistake that cannot be corrected easily, and usually results in financial failure. Likewise, attempts to use rapidly eroding cultivated land for the production of erosion-permitting crops is inviting crop failure and eventual destruction of the soil.

LAND USE RECOMMENDATIONS

In that area of the southern Plains lying east of the effective rainfall line (see map, inside back cover), most of the hard lands with deep soils are considered suitable for cropping if a relatively intense system of soil and water conservation is carried out. The medium-depth soils also are cultivated to a large extent, but much of this land is better adapted for grazing. Cultivation should be continued on the medium-depth soils only if no severe erosion has occurred in the past and if intensive soil- and water-conservation practices are followed. Cultivated land with medium-depth soils should be devoted largely to feed-crop production, except near the eastern edge of the region where greater rainfall may make the production of cash crops a profitable venture.

Along the extreme eastern edge of the region most of the hard lands and some of the shallow soils of gentle to moderate slope are suitable for cultivation. Wheat, sorghums, and other adapted crops are grown successfully in this area with comparatively infrequent crop failures where good water conservation and crop management practices are followed.

Dry-land farming on the hard lands lying west of the effective rainfall line is very hazardous. Only the lands of gentle slope should be cultivated, and a very intensive system of water and soil conservation must be used if profitable farming is to result. The cultivation of rolling lands where normal rainfall is less than 16 inches should be undertaken only as a dire necessity. A few small tracts of hard lands near the foothills of the mountains at the western edge of the region (see map, inside back cover) receive sufficient moisture for profitable crop production if proper conservation measures are carried out.

All cultivated hard lands that have been severely eroded by wind should be retired to permanent vegetation immediately. Since it is difficult to revegetate these tight soils, it may not always be advisable to retire lands that are only moderately eroded if they have a deep subsoil and retain some of the topsoil, especially those that lie in the higher rainfall belt.

LAND RETIREMENT

The first step in returning cultivated land to grass is to stop soil blowing. Stabilization of eroding hard lands can usually be accomplished by listing or chiseling on the contour and allowing weed growth to cover the land (fig. 3). For immediate stabilization, before weed growth covers the ground successfully, it is sometimes necessary to plant erosion-resistant crops, such as Sudan grass, broomcorn, sorgos or grain sorghums. Ordinarily only the severely eroded lands

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entirely bare of vegetation will require sorghum plantings for stabilization.

After soil erosion has been stopped and the organic matter of the soil rebuilt, a natural invasion of the weedy area by perennials and grasses may eventually reestablish a cover of plants suitable for grazing. The natural processes of revegetation are slow, many years being required for the land to become covered with high quality grazing plants, but revegetation may be hastened by planting adapted grasses during favorable seasons on land having an abundance of crop residue or other types of nongrowing cover. Native grasses, including blue grama, side-oats grama, sand dropseed, and buffalo grass, are

TEX—7826

FIGURE 3.—In retiring eroded hard lands to grass, stabilization can usually be accomplished by contour chiseling or listing, and allowing weed growth to cover the ground.

best adapted for this purpose and should be planted during the spring, preferably in April.

It is difficult to establish a stand of grass by seeding on land covered with growing weeds or volunteer crops that compete with small grass plants for moisture. Weeds that come up thickly after grasses are planted should be mowed. Sorghum cover crops on land to be planted to grass should be close-drilled, with rows 12 to 20 inches apart. The cover crop should be mowed high before it produces seed, and all the crop left on the ground as an added protection for the soil.

PASTURE TO CULTIVATION

Many small tracts and a few large areas of the deeper, more productive hard lands retain their native-grass cover and are used for pasture. Many of these tracts east of the effective rainfall line may be profitably cultivated. Since most farms of the region do not have a sufficient amount of pasture land, however, further breaking out of grassland should be undertaken only if the farm unit requires more cultivated land to produce an adequate farm income.

Seldom will it be found advisable to plow up virgin sod on any of the medium-depth or more friable soils, even in the eastern part of the region, and certainly to do so in the area west of the effective rainfall line is to invite disaster. Probably the plowing out of sod on medium-depth or erodible soils can be recommended only for farm units that have a large acreage of pasture and not enough good cropland to raise feed for the livestock necessary to use the pastures economically. A complete and well-coordinated soil- and water-conservation program should be established on all new lands at the time they are broken out in order that their native productivity may be maintained.

Water Conservation

Water conservation may be considered the key to successful farming and soil-erosion control on the hard lands of the Plains. Water conservation is not an end in itself, however; it is merely a means of making crop production more certain, which, in turn, provides plant cover for the land and is the best insurance against soil blowing.

Since water soaks into these tight soils very slowly, water conservation by mechanical means, such as terraces and contour tillage, becomes highly important. It is important on lands that remain in pasture as well as those that are cultivated. Mechanical structures and farming practices that not only keep rain and snow on the field where they fall but also keep them distributed evenly over the field are obviously the most desirable.

TERRACING

All the hard lands that are in cultivation should be terraced as a water-conservation measure (fig. 4). Terraces alone, however, are not sufficient for holding water on the land. They should be supported by contour tillage in order to give a more even distribution of water over the field (fig. 5). Terracing may be impractical on fields of irregular topography, but most of such land should be retired from cultivation. Likewise, fields with soil too shallow for proper terrace construction should be retired.

TEX—7922

FIGURE 4.—All the limited rainfall that occurs on the Plains is needed for crops. Level terraces with closed ends are an effective water conservation device for the hard lands.

TEX—17685

FIGURE 5.—Contour tillage checks run-off and helps keep water distributed evenly over a field. It should always be supported by terraces, as a safety precaution, on hard lands.

Terraces of various kinds are in use in the southern Plains, but most of them are of the absorptive, or retention, type. The base width of the terrace depends on the crop to be grown. If row crops are to be grown exclusively the terraces should have a base width of 30 to 35 feet for each foot of height. These are commonly called broad-base row-crop terraces. If wheat is to be grown at any time, the terrace should have a minimum base width of 40 feet in order to make the use of large planting and harvesting machinery practicable. These are commonly called wheatland terraces. These broader-base terraces, however, will be generally effective on only the more gentle slopes.

KANS-122

FIGURE 6.—The extremely broad-based terrace makes the use of large farming equipment practicable on terraced fields.

Another mechanical means of moisture conservation is the "sirup pan" system of terracing. This is a method of flood irrigation that originated in the southern Plains and consists of terraces with alternate ends closed. It was developed to collect surplus run-off from adjacent lands and distribute it over a field for an increased moisture supply (fig. 7). The system normally will be practicable only on fields with a slope of 1½ percent or less and where run-off from adjacent roadside ditches, pastures, or intermittent streams can be diverted economically onto the field.

CONTOUR TILLAGE

All tillage operations on cultivated fields with tight soils should be on the contour. Contour tillage may be impracticable on occasional fields with very irregular slope, but most land of such topography in the southern Plains should be retired from cultivation. Even on fields that are not terraced, contour tillage, especially if done with lister-type implements, will conserve a large amount of moisture that otherwise would be lost. Wherever contour tillage is used without terraces, a base-contour line should be run every 200 to 300 feet for the best results.

TEX—7925—E

FIGURE 7.—The sirup-pan system of terracing collects water from adjacent fields, pastures, or roadside ditches, and distributes it over the field for an increased moisture supply.

Tillage operations on terraced fields should always be parallel to the terraces and the point rows should fall approximately halfway between the terraces. Such methods not only give a more even distribution of water than can be obtained by terraces alone but also assist in their maintenance. It is equally important that harvesting operations, especially if done with heavy implements, be parallel to the terraces (fig. 8). Furrows plowed across a terrace, or even ruts caused by pulling farm implements across the ridge, may make low places that will permit run-off during heavy rains to overtop the terrace and seriously damage it.

FALLOW

Fallow has long been recognized as an effective means of storing moisture in the soil for dry-land farming. As a general rule, however, fallow gives the greatest increase in crop yields when carried out in connection with terracing, contour tillage, strip cropping, and other soil- and water-conservation practices (fig. 9).

On fields where wind erosion is a serious problem, fallow should be used with discretion. Fields that are fallowed during the winter and spring months should have a considerable quantity of crop residues on the surface or lightly mixed with the topsoil and should be left with a rough surface. If wind erosion has been severe the fallowed field should have strips of sorghum or wheat stubble on it during the blow season.

WATER-CONSERVING TILLAGE IMPLEMENTS

Damming listers, hole diggers, subsoilers, and various other special tillage implements have been developed as water-conserving devices for hard lands of the Plains. Many such implements have considerable merit and have given good results with proper use.

On nearly level or gently sloping land dammed lister furrows may hold all the water from moderate rains, but unless the field is terraced and the furrows are on the contour considerable run-off will usually follow heavy rains, especially if cultivation has destroyed the dams. The use of hole diggers, subsoilers, and other tillage implements designed to open up the surface soil and permit a more rapid penetration of water into the subsoil will likewise be more effective if such tillage operations are on the contour and the fields are terraced.

Crop Management

DIVERSIFICATION

A sound conservation-farming program must include a diversification of crops. Sorghums, being the most dependable erosion-resistant crops of the region, should be included in all cropping systems.

Continuous planting of large tracts of land to the same crop often results in crop failure that leaves the ground bare during critical blow seasons. Cotton or corn grown continuously usually deplete the organic matter of the soil and leave the ground susceptible to blowing.

Not only is diversification necessary as an erosion-control precaution, but also it seems to be the only system that offers any degree of economic security. A crop failure under a single-crop system means the loss of a year's income. If, however, the crops are diversified, the best water-conservation measures applied, and the land used for

KANS–257

FIGURE 8.—All tillage and harvesting operations should be on the contour on terraced fields. The strip-cropping system on this field enables the combine to harvest the wheat without running over any of the crop.

KANS–485–B

FIGURE 9.—Water conservation increases crop yields on the Plains. Run-off from the wheatfield at the left was caught by terraces on the strip-cropped field at the right. During a drought year, the water conserved made the difference between a crop failure and a fair crop. The land on both fields was fallowed the previous year.

purposes to which it is adapted, it is unlikely that all crops planted during the year will fail.

FLEXIBLE CROPPING SYSTEM

Because of the erratic character of the rainfall, it is impossible to plan a fixed cropping system for more than one season in advance in most areas of the southern Great Plains. A flexible cropping system that can be varied on short notice to fit the current seasonal conditions is recommended as a fundamental step in the farming program. The need for flexibility in cropping plans increases as the expected amount of rainfall decreases.

Most of the hard lands have a high water-holding capacity, and with proper management enough moisture can be stored in the soil before a crop is planted to insure the probability of a fair yield. Crops should not be planted in dry soil—they will probably fail.

The cropping system should be so planned that adapted crops, either cash crops or feed crops, can be planted any season when the soil contains moisture enough to insure the likelihood of a profitable yield.

STRIP CROPPING

Contour-strip cropping when properly applied is usually an effective erosion-control practice for the hard lands. It should not be applied to fields when in a seriously eroding condition. Such fields should first be stabilized with an erosion-resisting cover crop such as sorghum. Strip cropping then applied functions as an erosion-preventive measure, rather than a cure, by breaking the ground-sweep of wind currents and preventing large areas or entire fields from becoming an erosion hazard at any one time.

To be successful strip cropping must be accompanied by good tillage and residue management practices.

If wheat is the major crop, a strip-cropping system of wheat, sorghums, and fallow is recommended (fig. 10). Cotton, corn, or other clean-tilled crops should always be planted between strips of drilled sorghums or other erosion-resistant crops. In the extreme northeastern part of the region, a strip-cropping system of wheat and fallow has been successful on some fields where crop residues are conserved.

COVER CROPS

It is highly essential that hard lands which have blown badly and in which the organic matter has been depleted be protected with a cover of stubble, crop residues, or growing crops during the winter and spring months. Eroding land may be expected to blow severely if left bare during this critical blow season.

FIGURE 10.—A contour-strip rotation of wheat, fallow, and sorghum has been a satisfactory cropping system for the hard lands in many sections of the southern Plains. *A*, In July 1938, the strip at the left was being fallowed in preparation for wheat, and sorghum was growing on the strip at the right. *B*, In June 1939 on the same field, wheat was growing on the strip to the left, and the strip at the right, which grew sorghums in 1938, was being fallowed in preparation for wheat planting.

Wheat may make an effective winter cover crop if it makes sufficient growth during the fall and winter to cover the ground, but, except where soil moisture is sufficient at planting time to insure a good growth before the spring winds start, it should not be depended on if the land has been blowing. The ability of adapted varieties of sorghums to withstand drought and hold blowing soil in place makes them invaluable as cover crops. Densely grown sorghum stalks left on the ground afford excellent winter protection to the soil. Likewise, dense sorghum stubble, that is from 10 to 16 inches in height, makes a very good winter cover for blow lands (fig. 11). Such

COLO—3721—C

FIGURE 11.—Dense sorghum stubble makes effective winter cover for blow lands.

stalks or stubble not only check erosion but help to hold drifting snow on the land where it falls. Stalks and stubble that are needed for winter and spring cover should not be grazed.

On lands that have blown severely for several years it may be necessary to plant sorghum cover crops continuously for a period of years and return most of the residues to the soil before erosion can be checked to the extent that normal farming practices can be resumed. Dense-growing crops, stubble, or other residues that cover the ground are also the best check against water erosion.

BORDER STRIPS

Where hard lands used for wheat, cotton, corn, or fallow lie adjacent to fields that are blowing, or to dirt roads, it may be advisable

to plant field borders of sorghum cover crops. The stalks and residues of such border strips should be left on the ground during the winter and spring blow season. Strips of this type often may prevent the spreading of wind erosion from adjoining lands to large areas of a field. Border strips should have a minimum width of 25 to 30 feet and should be increased in width according to the severity of the nearby blow hazards.

Border plantings of cover crops cannot be recommended as a permanent practice if adjacent fields are blowing severely and continuously. Control of the nearby blow hazards seems the only safe practice in such areas because protective border strips will collect large deposits of drifting silt and soon the ground covered by the strips will become much higher than the rest of the field and may become hummocked and begin to blow.

CROPPING ADJUSTMENTS

Crop adaptations vary considerably between the northern and southern parts of the region due to the length of growing season and other factors, and cropping systems must vary across the region from east to west as the rainfall declines. In the subsequent discussion of adjustments in crops and cropping systems for a conservation program, the hard lands are divided into five problem-area groups as follows: [2] (1) The deep soils of the northern part of the region east of the effective rainfall line (problem-area group No. 2a) where wheat, sorghums, corn, and barley are adapted crops; (2) the deep soils of the central part of the region east of the effective rainfall line (problem-area group No. 2b) where wheat and sorghums are the principal crops; (3) the deep soils of the southern part of the region east of the effective rainfall line (problem-area group No. 2c) where cotton is the principal cash crop and wheat and sorghums also are adapted; (4) the medium-depth soils east of the effective rainfall line (problem-area group No. 4) that are usually adapted only for growing sorghum feed crops but sometimes may be used successfully for wheat production; and (5) the hard lands west of the effective rainfall line that are well adapted only for grazing but sometimes may be used for sorghum-feed production.

Recommendations for deep soils of the northern part of the region east of the effective rainfall line (problem-area group No. 2a).—Early maturing varieties of sorghums should largely replace corn. Barley is produced primarily because it fits into a cropping system with corn production and also is used as a catch crop in case of wheat failure. A

[2] Problem-area groups Nos. 2a, 2b, 2c, and 4, referred to in this publication, are taken from groupings of the land of the southern Great Plains made by the regional office of the Soil Conservation Service, Amarillo, Tex., published in Problem-Area Groups of Land in the Southern Great Plains. See footnote 1.

goal of balanced production through diversification of wheat, feed crops, and summer-fallow practices, as far as is consistent with seasonal conditions, is recommended. For safe production, a part of the wheat and sorghums for grain may be grown on fallow land each year. A contour-strip rotation of sorghums with wheat and fallow or with corn is recommended for wind-erosion control, and provisions should be made for leaving strips of wheat or sorghum stubble on the ground during the winter blow season.

Recommendations for deep soils of the central part of the region east of the effective rainfall line (problem-area group No. 2b).—Wheat is the most important crop and sorghums are of secondary importance. In the northern part of this area summer fallow is recognized as a generally desirable practice. Summer fallow in the southern part is considered of less importance but should be used when moisture is deficient and when undecayed organic matter in the soil is sufficient to protect the clean-fallowed land from wind erosion.

Where wheat is the major crop, either one of two cropping systems is recommended for lands that have not been severely eroded. (1) A flexible cropping plan may be followed whereby wheat is grown during years in which the soil moisture at planting time is sufficient to insure the likelihood of a successful crop and when crop residues in the soil are sufficient to prevent severe wind erosion if a failure of the wheat crop should occur. Sorghums should be planted during the spring or summer when soil moisture conditions were unfavorable for wheat the preceding fall. (2) A contour strip-cropping system may be used if wind erosion is a problem, with wheat, sorghums, and fallow in rotation. Wheat or sorghum stubble should be left on the ground during the winter- and the spring-blow season.

Fields that have been severely eroded by wind should be planted to sorghums and all residues left on the land until it is stabilized and the organic matter of the soil is replenished, after which normal cropping practices may be resumed.

Recommendations for deep soils of the southern part of the region east of the effective rainfall line (problem-area group No. 2c).—Cotton is the principal cash crop on most farms. Small grains and sorghums also occupy important places in the farming system. If wind erosion is a problem, a contour-strip rotation with wheat or cotton and sorghums should be used and residues from sorghums and small grains should be conserved and mixed with the topsoil.

Wheat sometimes may be seeded in the fall on cotton lands primarily as a cover crop and as a means of furnishing some winter grazing for livestock. Fields that have been severely eroded by wind should be planted to sorghums or other erosion-resistant crops until soil blowing is checked and the organic matter of the soil replenished, after which normal cropping practices may be resumed.

Recommendations for medium-depth soils east of the effective rainfall line (problem-area group No. 4).—Most large areas of hard lands with medium-depth soils lie in the central and northern part of the region and near the effective rainfall line, where rainfall approaches the minimum that will assure safe crop production even with the best water-conservation measures. The shallower soils and less favorable climate have been responsible for numerous crop failures where continuous wheat growing was practiced and severe wind erosion has often resulted in the low-rainfall areas.

The wheat acreage should be reduced materially on most of these lands. Severely eroded areas and the lands with relatively steep slopes should be retired from cultivation. Sorghums should be the principal crops, and most farms with lands largely of this type should be organized primarily around a livestock enterprise.

Where wheat is grown it should be in a contour strip-crop pattern with sorghums and fallow, and the sorghum strips should be at least as wide or wider than the strips of wheat or fallow. Fallow should never be practiced on eroding lands of this type, however, except when the soil contains sufficient crop residues to prevent severe erosion. Attempts to grow corn and cotton usually result in failure, but if it is deemed essential to grow such crops, near the eastern side of the region, a contour strip rotation with sorghums covering at least half the field, is recommended.

On farms where livestock is the principal enterprise it is highly essential that feed-crop failures do not occur often. To insure the production of some feed grains for livestock each year a part of the feed-crop acreage may be planted on summer-fallow land.

Recommendations for hard lands west of the effective rainfall line.—Most of the hard lands in this area have medium-depth soils. The shallower soils and unfavorable climatic conditions have been responsible for numerous crop failures on these lands. Large blocks have been abandoned and lie idle with no protective cover. The wheat acreage should be reduced to a minimum because past attempts at continuous wheat farming usually have resulted in severe soil erosion. Attempts to grow corn or cotton on these lands usually result in crop failures and almost invariably lead to severe wind erosion.

Severely damaged areas and the more sloping cultivated land should be retired to permanent vegetation. The land kept in cultivation should be used largely for the production of feed crops. Special care should be taken to grow erosion-resistant varieties either in solid plantings or in strips.

Farms in this area should be managed primarily as livestock farms, and it is highly essential that feed-crop failures do not occur often. To insure the production of some feed for livestock each year a part of the feed-crop acreage should be planted on summer-fallow land.

Fallow never should be practiced, however, except where stripped with sorghums and when the soil contains sufficient crop residues to prevent severe erosion.

Soil Management

It is necessary that the land surface be rough and cloddy or well protected with crop residue during the late winter and spring months if soil blowing is to be prevented. Stalks, straw, and other residues should never be burned off the land, and cultural practices should be designed to provide as continuous a cover of growing crops and crop residue as possible.

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Figure 12.—Crop residues mixed with the topsoil are effective in checking soil blowing.

TIMELY TILLAGE

Implements used in the preparation of land for wheat should leave crop residues lightly mixed in the topsoil or on the surface and provide a cloddy and ridged or furrowed surface (fig. 12). Such operations should be carried out when moisture is present in the soil to plow depth. The same practices should be followed in the early spring preparation of land intended for summer fallowing or summer crops. In cultivating crops for weed control the same objectives should be kept in mind. Tillage operations always should be on the contour.

Timely tillage practices, designed to prevent wind erosion and carried out as a part of the regular operations in crop production and

soil moisture conservation, should not be confused with emergency tillage which may be resorted to after neglect and abuses have resulted in the development of serious erosion conditions.

EMERGENCY TILLAGE

The use of emergency tillage methods that leave a cloddy or roughened surface is valuable in temporarily checking wind erosion. Owing to the fact that the subsoil clods soon break down when exposed to rain and winds, such methods are very temporary. On lands where the soil is powdery, emergency tillage measures are even more temporary in nature. Emergency tillage operations should follow the contour of the land in order that they may serve as a water-conservation practice if rains should occur soon thereafter.

Farm or Ranch Management

TYPE OF FARMING

On hard lands east of the effective rainfall line cash-crop farming has been the general practice. Since a conservation-farming program necessitates the growing of a considerable amount of sorghums to protect the soil, it will be desirable in most instances for straight-cash-crop farmers to change their type of farming to include the production or feeding of livestock. Since cash markets for sorghums and other feed crops are not dependable in many sections of the region, it will usually be more profitable and will insure a more stable income if feed crops are marketed through livestock.

It is highly essential that reserve feed supplies for livestock be stored on the farm in the form of stacked feed, in trench silos, or otherwise (fig. 13). Feed reserves that will carry the livestock of the farm through an entire year are desirable. This will make it unnecessary to dispose of livestock or buy large quantities of feed during drought years.

On farms where wheat is the principal crop, and where the amount of pasture land is small, the feed crops may be utilized by feeding them to transient feeder livestock or to hogs and poultry. The use of some of the land for Sudan grass or other temporary pasture crops may make dairy farming profitable.

Where cotton is the principal cash crop, much of surplus feeds that should be grown in the strip-cropping system and the pasturage that may be afforded by winter wheat can be utilized profitably by dairy cattle or a small herd of beef cattle. Hogs and poultry also may fit into the farm-management scheme on such farms; or transient

feeder livestock may solve the problem of utilizing the feeds grown on the farm.

On those farms in the low rainfall area where the hard lands are better adapted for grazing than for crop production, a radical change may be needed in the type-of-farming program. This is especially true where wheat or other cash crops have been grown extensively.

During the expansion period wheat production partly displaced the original ranch-and-livestock economy in many areas west of the effective rainfall line. The result, in most cases, was financial failure,

KANS-565

FIGURE 13.—Stacked feeds will remain usable for a long period in the dry climate of the Plains. Feed reserves for winter and drought years are very essential on diversified farms.

accelerated wind erosion on cultivated lands, and erosion damage to neighboring pastures.

A farm on these lands should be so organized that livestock production is the principal enterprise and feed crops should be grown on the smoother hard lands only where sandy soils are not available. Attempts to convert hard lands of this area into wheat farms, with livestock as a side line, will usually result in failure. A reorganization of the entire farm unit may be necessary to increase the acreage so that sufficient grazing land is available to support a livestock enterprise that will assure an adequate farm income.

FARM UNIT REORGANIZATION

Some of the evils of soil abuse in the southern Great Plains may be attributed to the fact that many farms are too small to provide an adequate income except by continuous cash-crop farming. It is improbable that a sound land use and conservation-farming program can ever be established on such farms until they are increased in size. The same may be said of many of the livestock farms of the region.

The size of farm that will produce sufficient income under a program of diversified farming varies considerably for lands of this class in different parts of the region. The size of farm needed will vary

TEX-324

FIGURE 14.—Trees may make a normal growth on hard lands of the Plains where extra water is diverted to and held on the tree site.

according to the kind of crops grown, the amount of rainfall received, the type of land, and other factors.

The problem of reorganizing the operating unit and increasing the size of the farm may on many farms become the first step in establishing a conservation-farming program. The problems involved in planning and reorganizing farm units are many and varied and will not be discussed in this publication.

WILDLIFE AND WOODLAND PROGRAM

Windbreaks and shelter belts to protect field borders and farmsteads are recommended especially where suitable tree sites can be found

to which surplus moisture can be diverted. Run-off water from pastures or roadside ditches may be diverted to plots where trees are planted (fig. 14). As at least 30 inches of water annually is required by trees if growth is to be near normal. The futility of planting trees on hard lands, where surplus moisture cannot be made available for their growth, is obvious.

Trees and shrubs may be used to some extent for gully control on the more rolling hard lands. Plantings of shrubs, trees, and other plants that afford food and shelter for wildlife are desirable around farm ponds. The life of many stock ponds can be materially lengthened by block plantings of shrubs near the upper end to keep silt carried by run-off from entering the pond. In all plantings of trees and shrubs, species adapted to this region should be used.

Retirement of cultivated land to grass, strip cropping, and the leaving of crop residues on the land, may be considered good wildlife management practices.

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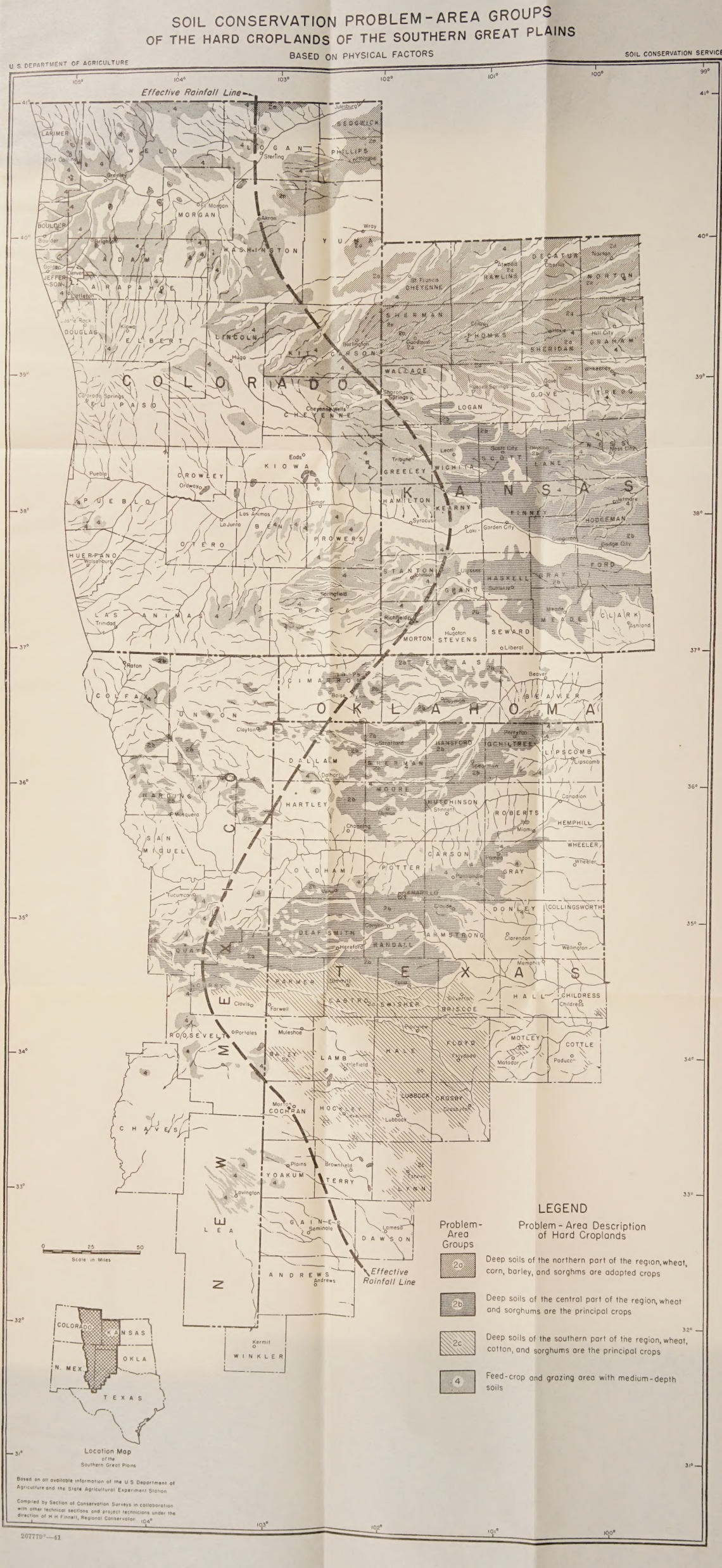
SOIL CONSERVATION PROBLEM-AREA GROUPS OF THE HARD CROPLANDS OF THE SOUTHERN GREAT PLAINS

BASED ON PHYSICAL FACTORS

U. S. DEPARTMENT OF AGRICULTURE — SOIL CONSERVATION SERVICE



Based on all available information of the U.S. Department of Agriculture and the State Agricultural Experiment Station

Compiled by Section of Conservation Surveys in collaboration with other technical sections and project technicians under the direction of H. H. Finnell, Regional Conservator

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Location Map
of the
Southern Great Plains

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